



Figure 6. PN removal in settling column during four experiments (squares), and the median values for the experiments (line).

Particulate nitrogen (PN) removals after 72 hr were 53-99%, with most removal occurring early, except in test 2, which had low removal early and achieved the lowest total removal (Figure 6). The 72-hr $\text{NO}_3\text{-N}$ removal averaged 70%, but was highly variable. Some of this removal may have been due to settling of particle sorbed $\text{NO}_3\text{-N}$, but the time course plots for $\text{NO}_3\text{-N}$ and $\text{NH}_4\text{-N}$ suggests there was also biological activity occurring in the columns (Figure 7).

In all tests there was an initial increase in $\text{NO}_3\text{-N}$ and a decrease in $\text{NH}_4\text{-N}$, which indicates nitrification (biological conversion of $\text{NH}_4\text{-N}$ to $\text{NO}_3\text{-N}$). Later, the nitrate began to decrease, probably due to a combination of cessation of nitrification, and the beginning of denitrification (biological reduction of $\text{NO}_3\text{-N}$ to N_2 gas). Some biological uptake (incorporation of $\text{NO}_3\text{-N}$ into PN) may have occurred also. Denitrification requires an oxygen-free environment, but the presence of this condition cannot be confirmed since dissolved oxygen was not monitored. However, given that the initial BOD_5 in some of the runoff samples exceeded 10 mg/l, hypoxia could have developed in the poorly aerated settling column. This would have also permitted the buildup of $\text{NH}_4\text{-N}$ from decomposition of organic matter (ammonification). Indeed, the $\text{NH}_4\text{-N}$ levels did begin to increase in three of the four experiments after about 24 hr. In the end, there was a net average increase in $\text{NH}_4\text{-N}$ amounting to about 30%. Because $\text{NH}_4\text{-N}$ is a small part of total nitrogen the TN removal pattern was not strongly affected by the increase. However, it should be noted that the maximum TN removals (37-60%) probably would have been lower had it not been for denitrification. This is an unlikely transformation in the detention pond however, because aeration there is likely much better than it is in the settling column.